

Additions to *Goniothalamus* (Annonaceae) in the flora of China

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Abstract: *Goniothalamus sesquipetalis* (Colebr. ex Wall.) Hook. f. & Thomson and *G. peduncularis* King & Prain are reported as two new records for the flora of China, the two species were found in Yingjiang, Yunnan, China and conserved in Xishuangbanna Tropical Botanical Garden. *G. lii* X.L. Hou & Y.M. Shui has been treated as synonym with *G. yunnanensis* W. T. Wang in Flora of China. Here, we clarified its taxonomical status and treated as a new synonym with *G. peduncularis* based on living plants observation, the type specimens and the literatures revision. *G. sesquipetalis* was previously known from India, Bangladesh and Myanmar, and *G. peduncularis* was only in Myanmar. In this paper, we update the description and illustrate them base on the herbarium specimens and living collections. The voucher specimens are deposited in the Herbarium of Xishuangbanna Tropical Botanical Garden (HITBC).

Key words: *Goniothalamus*, Annonaceae, new record, Yingjiang County, taxonomy

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中国哥纳香属（番荔枝科）植物新资料

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摘要: 番荔枝科 (Annonaceae) 是基部被子植物木兰目 (Magnoliales) 中较进化且物种数最多的科。目前的系统发育研究将番荔枝科划分为 4 个亚科: 蒙蒿子亚科 (Anaxagoreoideae)、

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澄光木亚科 (Ambavioideae)、番荔枝亚科 (Annonoideae) 和排石木亚科 (Malmeoideae), 有 107 属, 2 400 多种, 中国原产 21 属约 110 种。番荔枝科泛热带分布, 是热带植物区系的优势类群, 中国云南盈江位于云南省最西部边境, 与缅甸东北部接壤, 并与印度的东阿萨姆较近, 植物区系处于东南亚 (印度—马来西亚) 热带生物区系向东亚亚热带—温带生物区系的过渡地带, 属典型热带北缘性质, 在植被地理和生物地理上十分重要, 成为生物多样性保护的关键和热点地区。该区的热带雨林是印度阿萨姆和缅甸北部的热带雨林向东和向北扩散分布的边缘类型, 是东南亚热带雨林在纬度和海拔分布上的极限类型。该文报道了采自中国云南省盈江县, 引种保存于中国科学院西双版纳热带植物园的番荔枝科哥纳香属两个中国新记录种, 即皱叶哥纳香 [*Goniothalamus sesquipedalis* (Colebr. ex Wall.) Hook. f. & Thomson] 和长梗哥纳香 (*G. peduncularis* King & Prain)。中国植物志英文版 (*Flora of China*) 将盈江哥纳香 (*G. lii* X. L. Hou & Y. M. Shui) 处理为云南哥纳香 (*G. yunnanensis* W. T. Wang) 的异名, 基于活植物观察、馆藏标本和文献研究, 该文对盈江哥纳香的分类地位进行了澄清, 将其处理为长梗哥纳香的异名。皱叶哥纳香原记载产于印度、孟加拉和缅甸等地, 长梗哥纳香仅产于缅甸, 该文对它们进行了补充描述, 并提供彩色图版以便于鉴别。凭证标本存放于中国科学院西双版纳热带植物园标本馆 (HITBC)。哥纳香属两个新记录的发现, 丰富了中国番荔枝科植物多样性的认识, 为中国云南热带植物区系属于热带亚洲 (印度-马来西亚) 植物区系, 以及与缅甸北部、印度东北部植物区系的关系增加了例证。

关键词: 哥纳香属, 番荔枝科, 新记录, 盈江, 分类学

Goniothalamus (Blume) Hook.f. & Thomson, comprising over 130 species of trees and shrubs, are one of the largest palaeotropical genera in the Annonaceae, mainly distributed from India and Sri Lanka to tropical Australia and the South Pacific Islands (Saunders & Chalermglin, 2008; Nakkuntod et al., 2009; Turner, 2014; Thomas et al., 2017). In China, 11 species are currently recognized (Li & Gilbert, 2011).

During monitoring the living collections of Annonaceae in Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences from 2018 to 2021, two *Goniothalamus* species with flowering and fruiting were observed. The two species were introduced to Xishuangbanna Tropical Botanical Garden (XTBG) in 1997 and 2002. After a detailed examination of the morphological characters of our materials, related literatures, and herbarium specimens, we identified them as *Goniothalamus sesquipedalis* (Colebr. ex Wall.) Hook. f. & Thomson and *G. peduncularis* King & Prain, respectively. *G. sesquipedalis* was originally distributed in India, Bangladesh and Myanmar (Turner, 2015, 2018), and *G. peduncularis* was only reported in Myanmar (Turner, 2015, 2018). The two species therefore represent two new records for the flora of China, which we update the descriptions and illustrate them herein.

皱叶哥纳香 新拟, 图版 I; 图版 III: A

Goniothalamus sesquipedalis (Colebr. ex Wall.) Hook. f. & Thomson, Fl. Ind.: 108, 1855. (Plate I; Plate III: A)

Guatteria sesquipedalis Colebr. ex Wall. in Wallich, Pl. Asiat. Rar. 3: 42, t. 266, 1832. Type: Wallich, Pl. Asiat. Rar. 3: t. 266, 1832. (lectotype, designated by Turner, Nordic J. Bot. 33: 270, 2015).

Shrubs, to 2 m tall. Young branches glabrous. Leaf laminas oblong, 22–47 cm long, 5.7–10.5 cm wide, length/width ratio 3.4–7.2, apex acuminate to caudate, base cuneate, sometimes attenuate, coriaceous, glabrous abaxially and adaxially; midrib glabrous and (strong) prominent abaxially, glabrous and impressed adaxially; secondary veins 16–22 pairs, interarching 5–10 mm

from recurved margin, impressed adaxially, raised abaxially; tertiary veins reticulate, distinct; petioles 1.3–2 cm long, 2.5–5 mm in diameter, glabrous. Flowers greenish-yellow, solitary, axillary or extra-axillary, often on the main trunk (cauliflory) and on older branches (ramiflory); flowering pedicels 3–5 mm long; pedicel bracts 2–6, 2–4 × 1.5–3 mm. Sepals 3, 5–11 mm long, 5–7 mm wide, basally connate, apex acute to obtuse, ovate, puberulent abaxially, sparsely puberulent adaxially, greenish-yellow. Outer petals 3, 25–28 mm long, 6–8 mm wide, length/width ratio 3.1–4.6, lanceolate, puberulent abaxially and adaxially, greenish-yellow. Inner petals 3, shortly clawed and free in lower part, cohering and forming an ovate-caudate cone at apex, 15–18 mm long, 5–6.5 mm wide, length/width ratio 2.5–3, ovate-lanceolate, puberulous abaxially and adaxially, sometimes shortly lanate abaxially and adaxially in upper part, yellowish green, base obtuse to a 4.5–5 mm claw. Stamens 70–80 per flower, 2–2.2 mm long, 0.8–0.9 mm wide; connectives apiculate. Carpels ca. 12 per flower, ovary 2.5–3 mm long, light green, white pubescent; stigma and style 2–2.2 mm long, puberulous. Immature fruits green, mature fruits orange-red; fruiting pedicels 7–8.5 mm long, 2.5–3 mm in diameter. Monocarps one seeded, fresh monocarps 21–24 mm long, 10–12 mm wide, length/width ratio 2–2.2, dry monocarps 16–18.8 mm long, 6.9–7.4 mm wide, length/width ratio 2.2–2.7, ovoid to ellipsoid-ovoid, base rounded, apex attenuate, sparsely puberulous, glossy, pericarp medium-thick, ca. 2 mm thick, stipes 2–3 mm long, ca. 3 mm in diameter. Seeds 13–14 mm long, 6.5–7 mm wide, ovoid, testa slightly with latitudinal stripes, dark brown to black brown, aril yellowish brown, endosperm ruminations lamellate.

Distribution: China (Yunnan) (new record); India (Sikkim, Assam, Nagaland, Manipur, Meghalaya) (Grierson, 1984; Karthikeyan et al., 2009); Bangladesh (Khanam & Rahman, 2002); Myanmar (Kress et al., 2003; Kang et al., 2017).

Additional Specimens examined: China (中国). Yunnan (云南): Yingjiang County (盈江县), Xima Township (昔马乡), Nabangba (那邦坝), 24°44' N, 97°33' E, 400 m, 5 November 1974, Tao Guoda (陶国达) 013190 (specimen no. 001927[barcode, HITBC0040552!], specimen no. 001928[barcode, HITBC0040553!]); the same location, April 1979, s. coll. (specimen no. 066463[barcode, HITBC0040554!]); Yingjiang County (盈江县), Xima Township (昔马乡), 24°45' N, 97°42' E, 260 m, 3 December 1981, Tao Guoda (陶国达) 12774 (specimen no. 001929 [barcode, HITBC0040551!]); Yingjiang County (盈江县), Nabangba (那邦坝), Tongbiguan Natural Reserve (铜壁关自然保护区), 10 October 2011, Zhou Shishun (周仕顺) 11197 (HITBC 0040504); Yingjiang County (盈江县), Labang (拉邦), voucher from a cultivated plant at the Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, 21 July 2019, Yang Bin (杨斌), XTBG0077 (HITBC); 15 February 2020, Yang Bin (杨斌), XTBG0079 (HITBC); 9 May 2020, Yang Bin (杨斌) & Xiao Chunfen (肖春芬), XTBG0114 (HITBC); 24 May 2021, Yang Bin (杨斌), XTBG0243 (HITBC).

Notes: The specimens of *Goniothalamus sesquipedalis* deposited in Herbarium of Xishuangbanna Tropical Botanical Garden (HITBC specimen no. 001927, 001928, 001929, 066463) was previously misidentified as *Goniothalamus multiovulatus* Ast, which is native to Vietnam (Turner, 2018). *G. multiovulatus* can be differentiated from *G. sesquipedalis* by having 4.5–5.5 cm long, 2–2.5 cm wide, cylindrical monocarps with 2–4 hairy seeds per monocarp (Ast, 1938). Hou (2003) misidentified them (HITBC specimen no. 001927, 001928, 001929) as *Goniothalamus macrophyllus* (Bl.) Hook. f. et Thoms, which is distributed in Malaysia, Singapore, Indonesia, Thailand (Saunders, 2002; Saunders & Chalermglin, 2008; Turner, 2018). *G.*

macrophyllus differs from *G. sesquipetalis* by having the leaves with a distinctive and diagnostically important ‘granular’ appearance abaxially because of immersion of tertiary and lower order veins (Saunders, 2002; Saunders & Chalermglin, 2008). *G. sesquipetalis* differs from *G. macrophyllus* in several important respects: the leaves of *G. sesquipetalis* with secondary venation very prominent adaxially and forming intramarginal vein, tertiary venation prominent and reticulate, whereas the leaves of *G. macrophyllus* with secondary venation \pm plane to impressed adaxially and not forming intramarginal vein, tertiary venation un conspicuous (Saunders, 2002); *G. sesquipetalis* can also be distinguished from *G. macrophyllus* by having 3–5 mm (vs. 5–11.5 mm) long flowering pedicels; lanceolate, greenish-yellow (vs. ovate, orange-pink) outer petals when mature; ovate-lanceolate (vs. ovate), 15–18 mm (vs. 7–15 mm) long inner petals (Saunders, 2002; Saunders & Chalermglin, 2008).

长梗哥纳香 新拟, 图版 II; 图版 III: B

Goniothalamus peduncularis King & Prain, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 67: 284, 1898. (Plate II; Plate III: B)

Type: Burma, Upper Burma, Kachin Hills, Sima Road, 1000 feet, 1897, *Shaik Mokim s.n.* (lectotype CAL[CAL000004500], designated by Turner, Gard. Bull. Singapore 70 (1): 523, 2018; isolectotype K [K000380823], Plate III: B).

Goniothalamus lii X. L. Hou & Y. M. Shui, Acta Bot. Yunnan., 25(3): 258, 2003. **Syn. nov.** Type: China (中国). Yunnan (云南): Yingjiang County (盈江县), Xima Township (昔马乡), Nabangba (那邦坝), 300 m, 7 November 1974, Tao Guoda (陶国达) 013254 (holotype, KUN1263140, Plate III: C; isotype, HITBC [specimen no. 001921, barcode 0040594!])

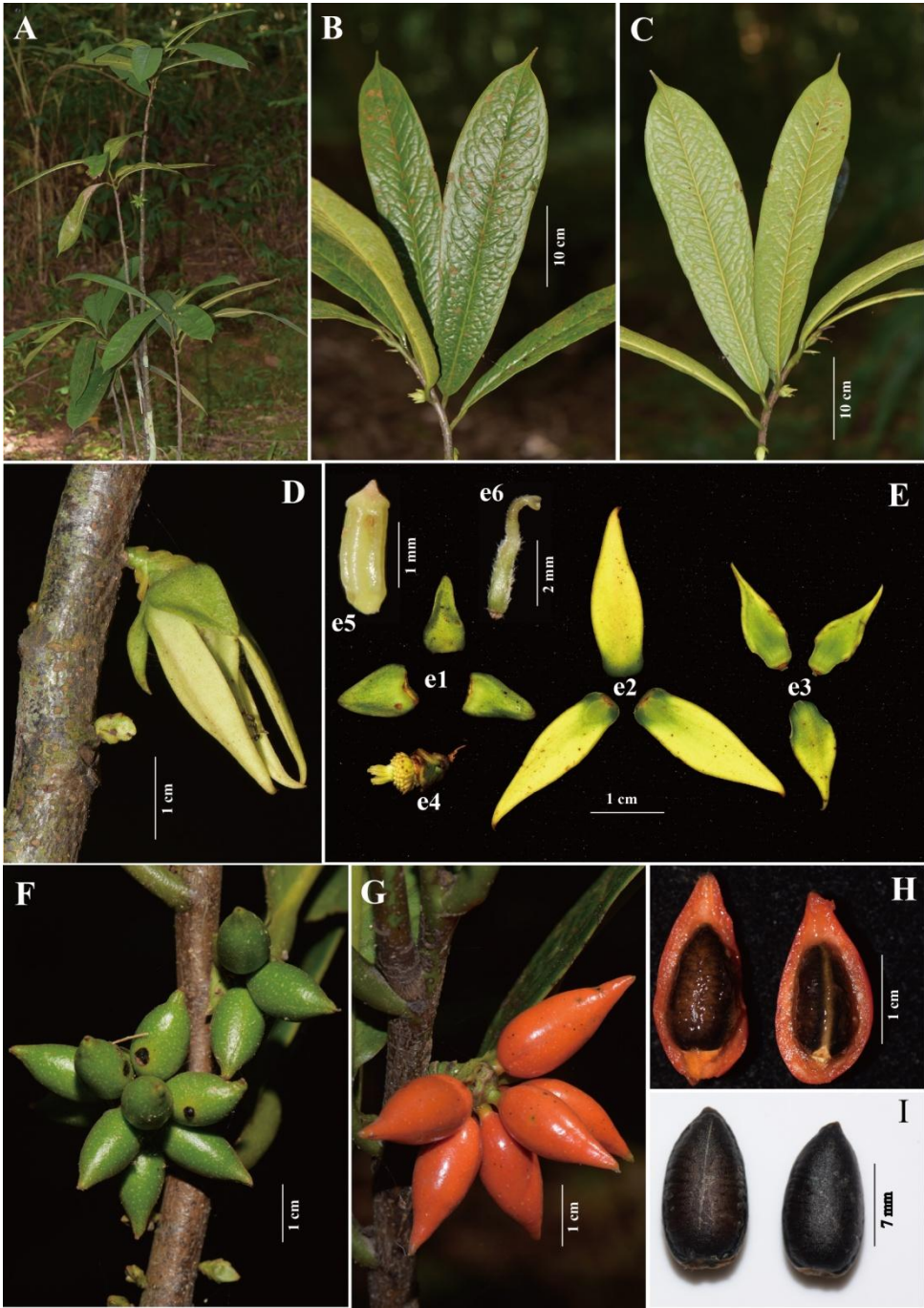
Shrubs, to 4 m tall. Young branches glabrous. Leaf laminas oblong, elliptic-oblong to oblanceolate-oblong, 15–23 cm long, 4.4–7 cm wide, apex acuminate, base cuneate, thinly papery, glabrous abaxially and adaxially; midrib raised abaxially, impressed adaxially; secondary veins 10–16 pairs, interarching 3–7 mm from recurved margin, impressed adaxially, raised abaxially; tertiary veins reticulate, raised abaxially, un conspicuous adaxially; petioles 8–13 mm long, with shallow furrows adaxially, glabrous, black when dry. Inflorescence often solitary, sometimes 2-flowered, axillary, often on the main trunk (cauliflory) and rarely on older branches (ramiflory); peduncle degenerate, 1–2 mm long; flowering pedicels 9–15 mm long; pedicel bracts 2–4, 1–2 mm long, ca. 1 mm wide. Sepals 3, ovate, 5–7 mm long, 3–6 mm wide, basally connate, apex acute to obtuse, sparsely puberulent abaxially, conspicuous puberulent along margin, puberulent adaxially, yellowish-green. Outer petals 3, 25–37 mm long, 12–16 mm wide when fresh, 24–34 mm long, 9–12 mm wide when dry, ovate to ovate-lanceolate, puberulent abaxially and adaxially, often yellowish-green, grey white when mature. Inner petals 3, shortly clawed and free in lower part, cohering and forming an ovate-attenuate to ovate-acuminate cone at apex, 13–15 mm long, 5–6 mm wide when fresh, 12–14 mm long, 4–5 mm wide when dry, ovate-lanceolate to oblong-lanceolate, puberulous abaxially and adaxially, densely in upper part, greenish yellow, base obtuse to a 2–3 mm claw, apex attenuate to acuminate. Stamens ca. 100 per flower, 2.5 mm long; connectives slightly apiculate, sometimes hemispherical when dry, yellowish brown pubescent. Carpels 20–30 per flower, ovary ca. 2 mm long, greenish-yellow, white pubescent; stigma and style 2–3 mm long. Immature fruits green, mature fruits deep blackish blue; fruiting pedicels 1.2–1.5(–4.8) cm long. Monocarps 4–25, 1–2 seeded per monocarp, fresh monocarps 17–25 mm long, 8–9 mm wide, ellipsoid to ellipsoid-oblong, base rounded, apex rounded with a

small tip, sub-glabrous to sparsely puberulent, pericarp ca. 1 mm thick when fresh, stipes 5–12 mm long. Seeds 10–13 mm long, 6.5–8 mm wide, ellipsoid, testa with white puberulous hairs outside, yellowish brown when immature, endosperm ruminations lamellate.

Distribution: China (Yunnan: Yingjiang, Cangyuan, Menghai) (new record); Myanmar (Kress et al., 2003; Turner, 2015, 2018).

Additional specimens examined: China (中国) . Yunnan (云南) : Yingjiang County (盈江县), Xima Township (昔马乡), Nabangba (那邦坝), 300 m, 10 December 1978, Tao Guoda (陶国达) 17895 (specimen no. 002077[barcode, HITBC0040544!]); Menghai County (勐海县), Mengman Township (勐满镇), 995 m, 22°9'25.23" N, 100°5'34.29" E, 28 June 2021, Zhou Shishun (周仕顺) 19431 (HITBC); 909 m, 22°10'50.79" N, 100°4'32.98" E, 29 June 2021, Zhou Shishun (周仕顺) 19474 (HITBC); Cangyuan County (沧源县): Banhong Township (班洪乡), Fabaomanguke (法保芒库河) 700 m, 30 May 1974, Li Yanhui (李延辉) 11770 (specimen no. 001923[barcode, HITBC0040547!], specimen no. 001925[barcode, HITBC0040545!]); 780–800 m, 2 June 1974, Li Yanhui (李延辉) 11873 (specimen no. 001926[barcode, HITBC0040546!], Plate III: C1); Banlao Township (班老乡), Shangbanlao (上班老) 900 m, 21 May 1975, Li Yanhui (李延辉) 20975 (specimen no. 001922[barcode, HITBC0040548!]); Yingjiang County (盈江县), Longmen (陇门), voucher from a cultivated plant at the Xishuangbanna Tropical Botanical Garden, 21 April 2021, Xiao Wenqiang (肖文强), C400663 (HITBC0031632!); 6 May 2019, Sheng Caiyu (盛才余), C400846 (HITBC0031129!); 26 May 2020, Yang Bin (杨斌) & Xiao Chunfen (肖春芬), XTBG0128 (HITBC).

Notes: *Goniothalamus lii* X. L. Hou & Y. M. Shui was characterized by its oblong or oblong-lanceolate leaf blades with (10–)13–21 pairs of lateral veins, pedicels 9–13 mm long, sepals ca. 5 × 4 mm, outer petals 2.5 × 1.3 cm, the stamens with hemispherical connectives, sometimes with densely brownish puberulent (Hou & Shui, 2003), all these characters are consistent with *G. peduncularis*. Moreover, examination of relevant type materials of *G. lii* and observations on living plants of *G. peduncularis* introduced from Yingjiang County show that both species share the liner style and ellipsoid monocarps. Therefore, *G. lii* is considered as conspecific with *G. peduncularis*, and we propose it as a synonym with the latter in this study. In Flora of China, Li & Gilbert (2011) synonymized *G. lii* with *G. yunnanensis* W. T. Wang (Plate III: D) (Wu & Wang, 1957) without further explanation. We don't agree with that treatment, however. As Hou & Shui (2003) mentioned in the protologue of *G. lii*, it is morphologically similar to *G. yunnanensis*, but clearly differs by having 10–21 (vs. 7–9) pairs of lateral veins and pedicels 9–13 mm (vs. ca. 4 mm) long. Moreover, based on our observations of living plants, the distinction between these two species is obvious on many other characters. *G. lii* (here as *G. peduncularis*) has grey white outer petals when mature (Plate II: d3), styles linear (Plate II: d7), monocarp stipes 5–12 mm long (Plate II: E, F, G), and monocarps deep blackish blue when mature (Plate II: F); whereas *G. yunnanensis* has reddish brown outer petals when mature, styles stick shape (Jiang & Li, 1979), and monocarp stipes very short, less than 2mm, and monocarps orange red to dark red when mature.

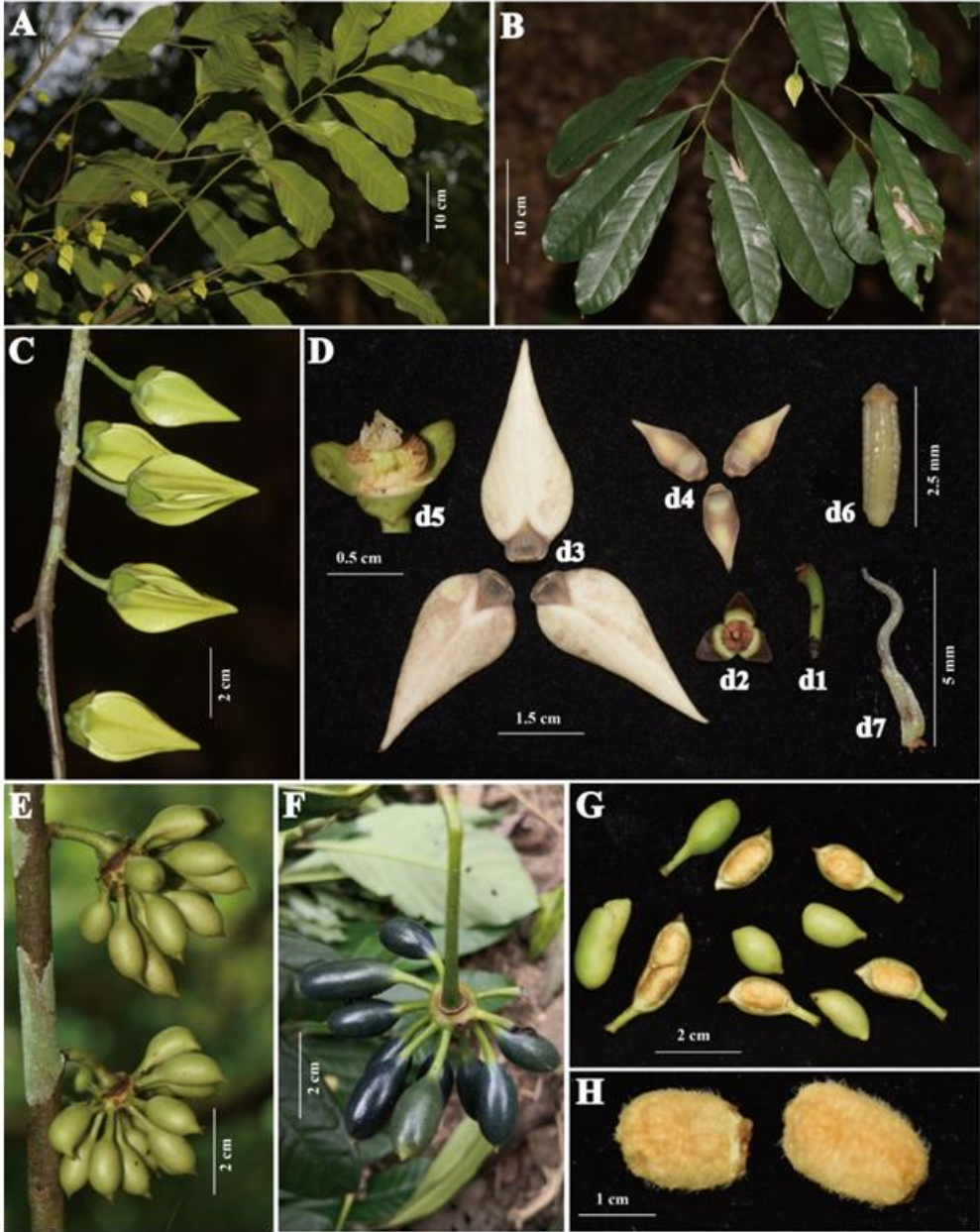


A. 植株；B. 花枝（正面）；C. 花枝（背面）；D. 花；E. 花解剖（e1. 花萼；e2. 外轮花瓣；e3. 内轮花瓣；e4. 雄蕊和心皮；e5. 雄蕊；e6. 心皮）；F. 未成熟果；G. 成熟果；H. 单果纵切；I. 种子。照片由杨斌拍自西双版纳热带植物园。

A. Plant; B. Flowering branch (front view); C. Flowering branch (back view); D. Flower; E. Dissection of a flower (e1. Sepals; e2. Outer petals; e3. Inner petals; e4. Stamens and carpels; e5. Stamen; e6. Carpel); F. Immature fruits; G. Mature fruit; H. Longitudinal section of monocarps; I. Seeds. Photographed by Yang Bin, taken from XTBG.

图版I 皱叶哥纳香

Plate I *Goniothalamus sesquipedalis* (Colebr. ex Wall.) Hook. f. & Thomson

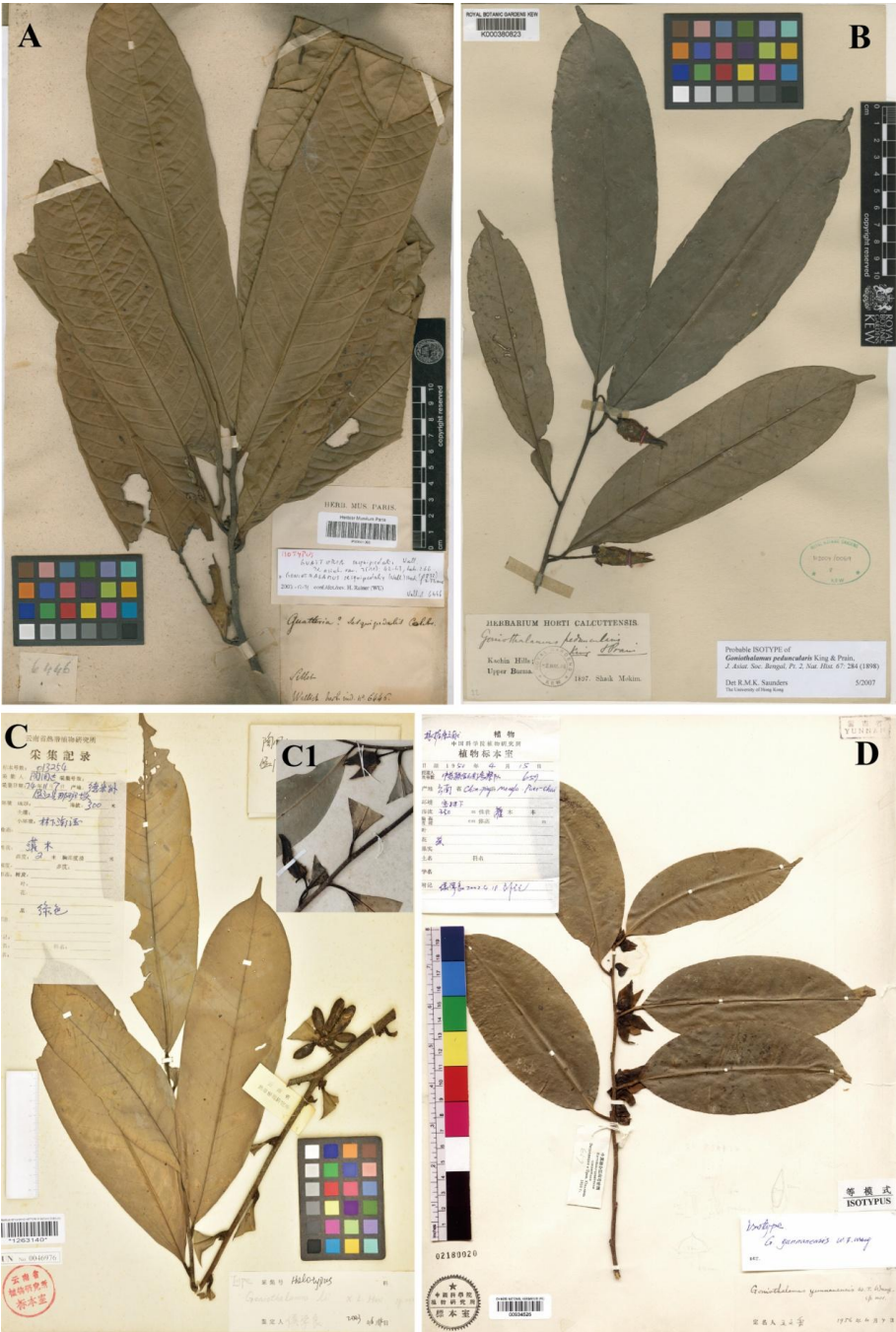


A-B. 花枝；C. 花；D. 花解剖（d1. 花梗；d2. 花萼；d3. 外轮花瓣；d4. 内轮花瓣；d5. 花摘除花瓣后展示雄蕊和心皮；d6. 雄蕊；d7. 心皮）；E. 未成熟果；F. 成熟果；G. 单果；H. 种子。照片A-E, G-H由杨斌拍自西双版纳热带植物园；F由王立彦拍自盈江。

A-B. Flowering branch; C. Flowers; D. Dissection of a flower (d1. Pedicel; d2. Sepals; d3. Outer petals; d4. Inner petals; d5. Flower stamens and carpels; d6. Stamen; d7. Carpel); E. Immature fruits; F. Mature fruit; G. Monocarps; H. Seeds. Photos: A-E, G-H by Yang Bin, taken from XTBG; F by Wang Liyan, taken from Yingjiang.

图版II 长梗哥纳香

Plate II *Goniothalamus peduncularis* King & Prain



A. 皱叶哥纳香等模式标本；B. 长梗哥纳香等模式标本；C. 盈江哥纳香主模式标本[C1. 盈江哥纳香发表时引证标本（HITBC0040546）一花]；D. 云南哥纳香等模式标本。

A. Isotype of *Goniothalamus sesquipetalis* (Colebr. ex Wall.) Hook. f. & Thomson; B. Isotype of *G. peduncularis* King & Prain; C. Holotype of *G. lii* X. L. Hou & Y. M. Shui [C1. Flowers voucher specimen (HITBC0040546)]; D. Isotype of *G. yunnanensis* W. T. Wang.

图版 III 四种哥纳香模式和引证标本

Plate III Type specimens and voucher specimen in the protologue of four species of *Goniothalamus*

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